APPENDIX C

Infiltration Test Plan

Test Plan for Effluent Infiltration Tests

Prepared for

The Tulalip Tribes
6326 33rd Avenue NE
Marysville, Washington 98271-7433

Prepared by

Parametrix
1231 Fryar Avenue
P.O. Box 460
Sumner, Washington 98390-1516
(253) 863-5128
www.parametrix.com

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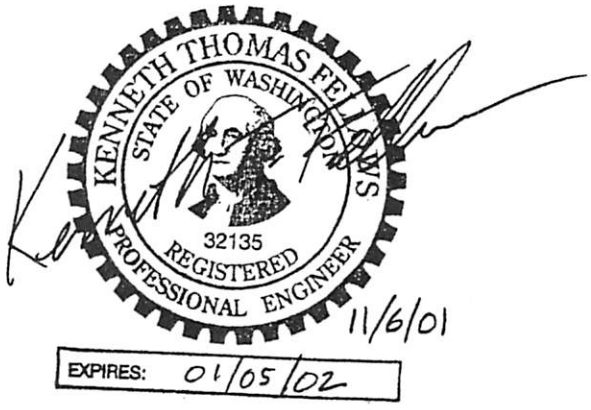
CERTIFICATE OF ENGINEER

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.



Prepared by Kenneth T. Fellows, P.E.

Checked by Brandon R. Ball, P.E.

Approved by Doug Berschauer, P.E.

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1. BACKGROUND

This document provides a Test Plan for conducting long-term, high-volume infiltration tests to aid the design work for infiltration of effluent from the proposed membrane treatment plant. The purpose of the infiltration testing is to further refine the estimates of hydraulic conductivity of the aquifer to better assess groundwater mounding. Prior infiltration tests have been similar to septic system perc tests, and have used very small basins and low infiltration volumes. While these tests indicate that the sandy site soils can readily accept a high rate of recharge for a short duration, they have not infiltrated sufficient qualities of water to yield any data about groundwater mounding.

1.1 TEST MANAGER

Ken Fellows
Parametrix, Inc.
P.O. Box 460
Sumner, WA 98390
253-863-5128
Fax: 253-863-0946
Kfellows@parametrix.com

1.2 OWNER

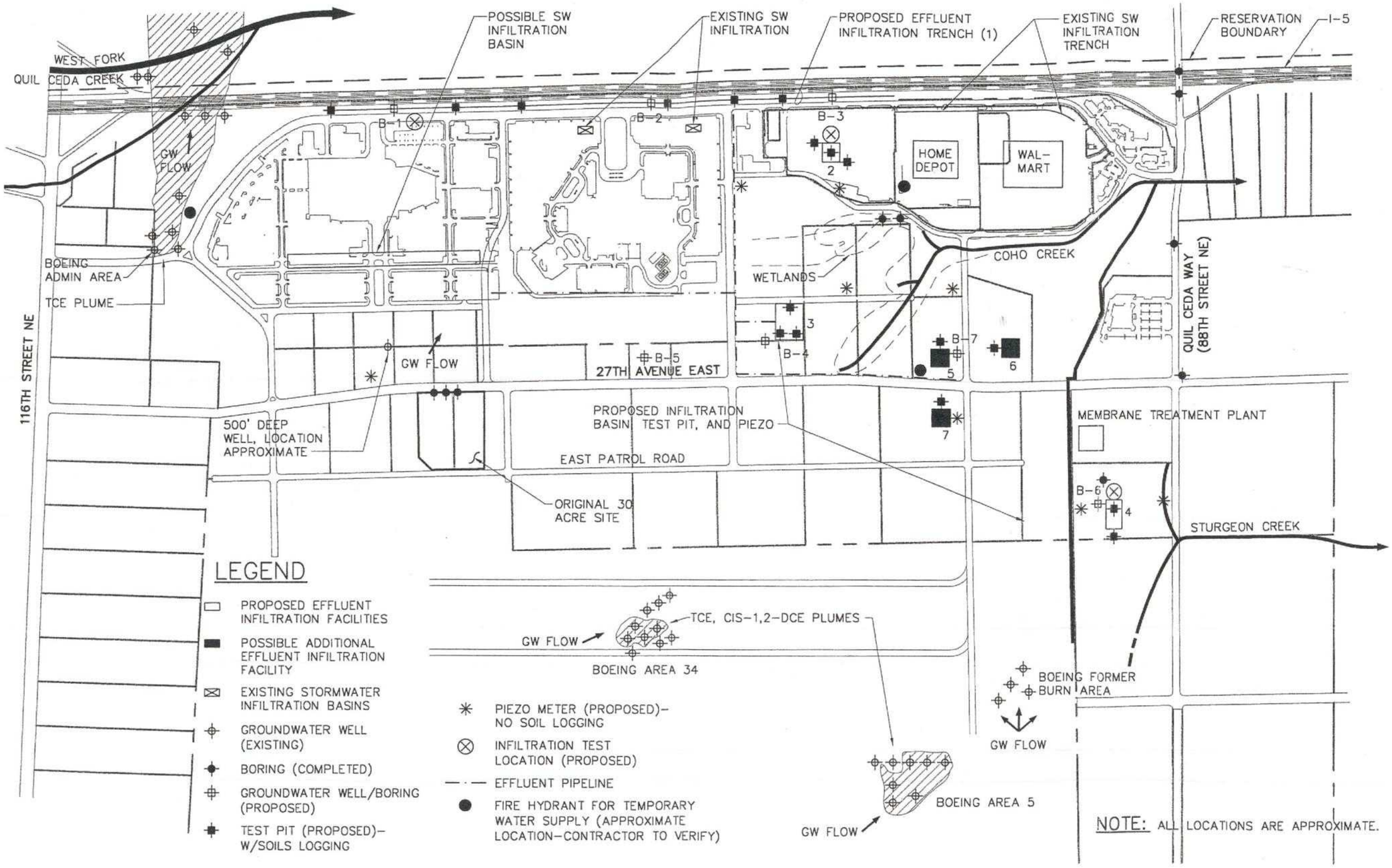
The Tulalip Tribes of Indians
T. M. (Mac) McKinsey
6326 33rd Avenue NE
Marysville, WA 98271-7433
360-651-3279
Fax: 360-651-3272
Tmac@tgi.net

1.3 TEST LOCATIONS

Complete infiltration tests at three separate locations to assess if the variability is infiltration and mounding conditions:

1. On Quilceda Boulevard extension east of the Chelsea retail site
2. West of Quilceda Boulevard, north of Home Depot
3. North of Sturgeon Creek headwaters

Figure 1 indicates the proposed testing locations. The exact test locations will be staked by the Test Manager.



E: 15981204F03
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0 400 800
SCALE IN FEET

N

Figure 1
Proposed Effluent Infiltration Investigation/Design Plan
Tulalip Tribe Development

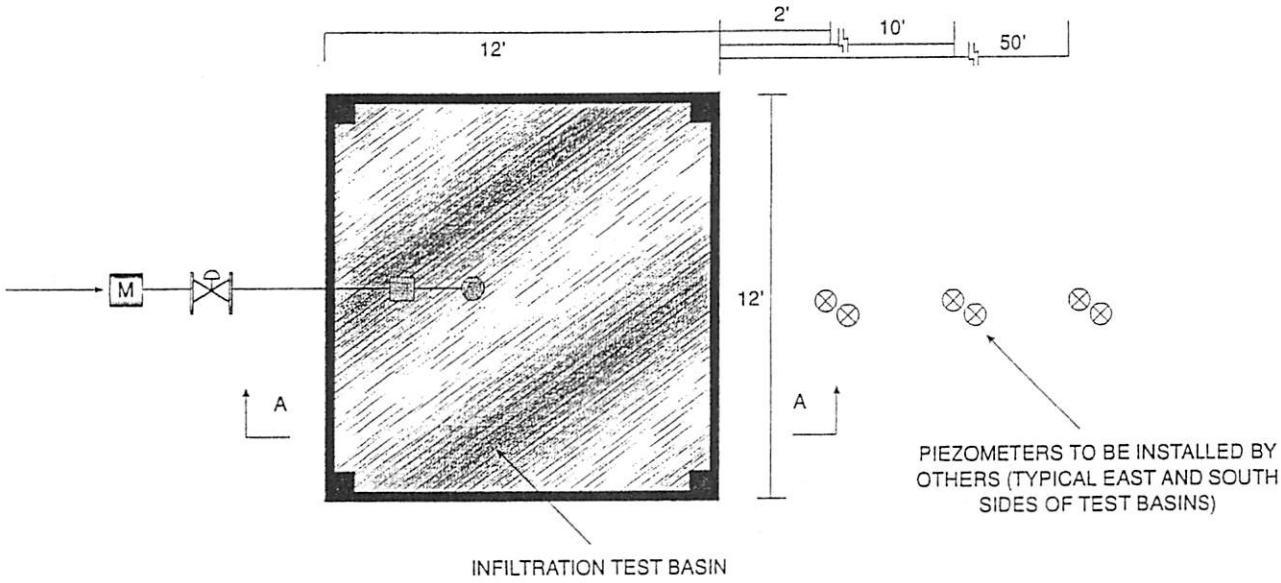
1.4 TEST FACILITIES

Construct the infiltration test basins using basins approximately 12-foot-square by 2-foot-deep. Basins must be lined with untreated dimensional lumber, adequate to hold back surrounding soil. Figure 2 provides a diagram of a typical infiltration pond test setup. Supply all required materials, labor, and equipment to construct the test facilities and provide an uninterrupted temporary water supply (see below), except that piezometers for measuring groundwater levels will be installed by the Owner under a separate contract.

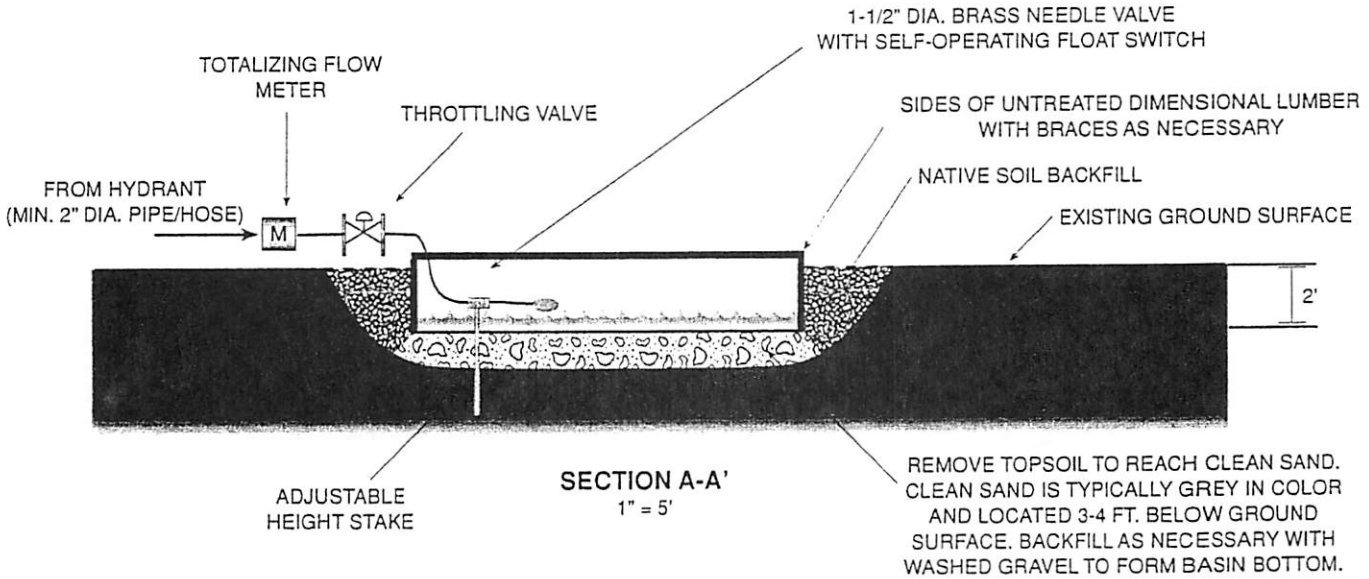
1.5 TEMPORARY WATER SUPPLY

Provide for a constant flow to each pond of approximately 10,000 to 20,000 gallons per day (7 to 14 gallons per minute). This flow rate may need to be refined based on observed field conditions. Water for the two infiltration test sites near Quilceda Boulevard can be obtained from fire hydrants located along either 27th Avenue NE or Quilceda Boulevard. Water to the Sturgeon Creek site can be obtained from fire hydrants on 27th Avenue NE (run supply line through Coho Creek culvert under 27th Avenue NE).

Temporary water supply pipes and hoses must be a minimum of 2 inches in diameter, and must be run to avoid any crossings of primary roadways. For secondary roadway crossings, protect pipe/hoses with plywood or steel ramps and provide appropriate signage. In the event that a single temporary water supply pipe/hose supplies two test sites, provide a pipe/hose a minimum of 4 inches in diameter.



PLAN VIEW
1" = 5'



SECTION A-A'
1" = 5'

N

Figure 2
Infiltration Test Basin Construction Plan

2. TEST OPERATIONS

2.1 TEST REQUIREMENTS

Notify the Test Manager and Owner 2 days prior to startup. Test Manager must be present to begin test.

Conduct the three infiltration tests sequentially, start one test per day. Operate each test continuously, with uninterrupted water flow.

Provide three persons continuously on site for startup day of each test. Thereafter, provide at least one person from 6 a.m. to 10 p.m. daily to monitor test conditions at all three sites, adjust and repair equipment, and notify Test Manager of any problems. Inspect each infiltration test site at least once every 2 hours from 6 a.m. to 10 p.m. Test Manager will be present on site for at least 4 hours during startup of each test.

Conduct data monitoring and report as required (see below). Record additional information as necessary to document any unusual occurrences (such as stop/start times for interruptions to temporary water supply, heavy rains, etc.)

Do not disturb any continuous recording devices provided by others.

Maintain site and equipment in good condition. Maintain piezometers with caps in place at all times except when conducting monitoring. Check that air holes in caps are clear.

Maintain and monitor a manual ram gauge, accurate to nearest 0.1 inch.

2.2 TEST DURATION

Each test will last a minimum of 1 week, and may last as long as 3 weeks, depending up the mounding observed. The Test Manager will determine when to terminate each test. Each of the three tests may terminate at different times.

2.3 MONITORING AND REPORTING

Table 2-1 summarizes the monitoring and reporting required for the infiltration testing. Groundwater level monitoring will be required twice daily at approximately 35 locations within an area bounded by 116th Street NE, Quilceda Boulevard, 88th Street NE, and 27th Avenue NE, and at Sturgeon Creek headwaters.

Data reports must be completed on the form located in Appendix A of this Test Plan. Data reports must be neatly handwritten or typed.

Fax completed data forms to Test Manager daily.

Within 3 days following completion of tests, organize all original data forms into a labeled notebook and provide to Test Manager.

Table 2-1. Data Monitoring and Reporting Requirements

Parameter	Equipment	Monitoring[a]	Reporting[a]
Water flow volume (each basin)	Standard Water Meter (turbine type), with totalizing meter	**Initial Reading** **Every 12 Hours During Testing[b]** – Record total accumulated flow **Final Reading**	Daily
Water ponding height (each basin)	Measuring Tape	**Every 12 Hours**	Daily
Groundwater levels (piezometers and wells)	Electronic groundwater depth meter[c]	**Pre-Test Levels** **Every 12 Hours During Testing[d]** – Measure depths to groundwater **Post Test Levels** (every 12 hours for 7 days following end of infiltration, then once every 3 days for the next 2 weeks)	Daily
Observations of general test conditions/problems	None	**Every 2 Hours Minimum, 6 a.m. to 10 p.m. daily, Including Weekends.**	Daily

[a] Use Data Form located in Appendix A.

[b] On first day of testing, read hourly.

[c] Provide 3 meters on first day of each test. Maintain 2 meters at all times thereafter.

[d] At startup, measure groundwater levels in the 12 piezometers adjacent to the test site as follows:

- First 30 minutes: Every minute
- 30 minutes to 3 hours: Every 5 minutes
- 3 hours to 12 hours: Every 15 minutes
- 12 hours to 48 hours: Every 3 hours (except 10 p.m. to 6 a.m.)

2.4 TEST PRECAUTIONS

Observe the following precautions at all times during testing, and notify the Owner and Test Manager promptly if deviations occur:

- Maintain constant water flow rate.
- Do not allow water to rise excessively and spill from wood box.
- Do not interrupt temporary water supply and allow pond to go dry. Be alert for kinked or damaged hoses or other problems.
- Fix leaking pipes/hoses as necessary to prevent soil erosion, water ponding, or other problems.

2.5 CLEAN UP

Upon written direction from the Test Manager, remove and properly dispose of all test equipment and materials. Clean test sites of all debris. Test basins need not be backfilled.

APPENDIX A

Daily Test Data Form

DAILY TEST DATA FORM
TULALIP TRIBES – FILTRATION TESTING

Infiltration Basin Number: _____

Note Taker (Name/Telephone No.): _____

Date: _____

Time (0000 – 2400)	Item	Value	Comments
	Flow Volume Meter Reading (gallons)		
	Flow Volume Meter Reading (gallons)		
	Water Ponding Height (inches)		
	Water Ponding Height (inches)		
	Piezometer 1 – Depth to GW (nearest 0.01 foot)		
	Piezometer 2 – Depth to GW (nearest 0.01 foot)		
	Piezometer 3 – Depth to GW (nearest 0.01 foot)		
	Piezometer 4 – Depth to GW (nearest 0.01 foot)		
	Piezometer 5 – Depth to GW (nearest 0.01 foot)		
	Piezometer 6 – Depth to GW (nearest 0.01 foot)		
	Piezometer 7 – Depth to GW (nearest 0.01 foot)		
	Piezometer 8 – Depth to GW (nearest 0.01 foot)		
	Piezometer 9 – Depth to GW (nearest 0.01 foot)		
	Piezometer 10 – Depth to GW (nearest 0.01 foot)		
	Piezometer 11 – Depth to GW (nearest 0.01 foot)		
	Piezometer 12 – Depth to GW (nearest 0.01 foot)		
Comments/Observations (problems, weather conditions, etc.):			

COST QUOTATION FORM
EFFLUENT INFILTRATION TESTING

Firm: _____

Address: _____

_____

Date: _____

Person: _____

Telephone Number: _____

Person to be Responsible for Contract Execution: _____

Qualifications:

_____

_____

_____

Deviations from Scope or Contract:

_____

_____

_____

COST QUOTATION FOR
EFFLUENT INFILTRATION TESTING

Item	Cost Form	Unit Cost (numbers)	Estimated Quantity	Extended Cost (numbers)	Extended Cost (words)
1. **Construction of Infiltration Basins** (including supply of all materials and equipment necessary for testing, and removal at end of project, all three sites)	Lump Sum		1		
2. **Provide Temporary Water Supply and All Other Test Equipment**	Lump Sum		1		
3. **Operation, Monitoring, and Reporting** (First week, all three sites)	Lump Sum		1		
4. **Operation, Monitoring, and Reporting** (Additional days, each site)	Per Site, Per Day		21		
Subtotal					
Sales Tax (8.2%)					
Total Cost					